ZOOLOGICAL SCIENCE 1: 819–827 (1984)

Cestodes of Bats from Japan, with Descriptions of New Species of the Genus *Vampirolepis* (Cestoda: Hymenolepididae)*

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ABSTRACT — Hymenolepidid cestodes, six species (including two new) and an unidentified larva of the genus *Vampirolepis* and two known species of the genus *Hymenolepis*, are recorded from cave bats taken at various localities in Japan in 1983. *Vampirolepis tanegashimensis* sp. n. and *V. wakasensis* sp. n. are described from the large-footed bat, *Myotis macrodactylus*, of Tanegashima, Kagoshima Prefecture and of Kaminaka-chô, Fukui Prefecture, respectively. *V. tanegashimensis* most closely resembles *V. multihamata* Sawada, 1967, but differs from it in longer strobila, larger scolex, longer neck and larger testes. *V. wakasensis* most closely resembles *V. tanegashimensis*, but differs from it in longer strobila, longer and more rostellar hooks, and in the morphological features of the ovary (transversely elongated form vs. bilobed form) and the vitelline gland (trilobated form vs. compact form). An unidentified *Vampirolepis* larva is reported from *M. macrodactylus* of Tanegashima, Kagoshima Prefecture.

A large number of cave bats were examined for parasites to obtain supplementary data on the helminth fauna of bats in Japan. This paper reports cestodes found, with descriptions of two new species.

MATERIALS AND METHODS

Bats were collected at various localities in Japan (Fig. 1) from January to December, 1983. The bats were autopsied immediately after capture at the collection sites. Their alimentary canals were cut open as soon as possible and fixed in Carnoy's fluid. After the alimentary canals were soaked in 45% acetic acid for 30 minutes for expanding, they were stored in 70% alcohol. Cestodes obtained from the alcohol-preserved alimentary canals, were stained with Heidenhain's iron haematoxylin, dehydrated in alcohol, cleared in xylene, and mounted in Canada balsam. Measurements are given in millimeters.

Accepted May 1, 1984
Received March 1, 1984
* This paper corresponds to "Helminth Fauna of Bats in Japan XXXII".

RESULTS

Bats examined and cestodes obtained are shown in Table 1.

Vampirolepis Spassky, 1954

Vampirolepis tanegashimensis sp. n.
(Fig. 2)

Of 17 bats, *Myotis macrodactylus*, obtained from a disused tunnel at Nakatane-chô, Kagoshima Prefecture, on August 27, 1983, one was found to be infected with two specimens of this cestode. They were fully mature but not gravid.

Description: Medium-sized hymenolepidid; strobila 42–46 long and 1.3–1.5 wide. Metamerism distinct, craspedote, margins not serrate. Scolex 0.277 long and 0.457 wide, not sharply demarcated from neck. Rostellum, 0.138 long and 0.152 wide, armed with a single circle of 40 Y-shaped hooks 0.032 in length. Hook handle long; guard round at its end, slightly shorter than or equal to blade; blade sharp at its end. Rostellar sac oval, 0.249 by 0.207, extending posteriorly to suckers. Suckers round to oval, 0.124 by 0.110. Neck slender, 2.5 long and 0.25 wide.

Genital pores unilateral, located a little anterior

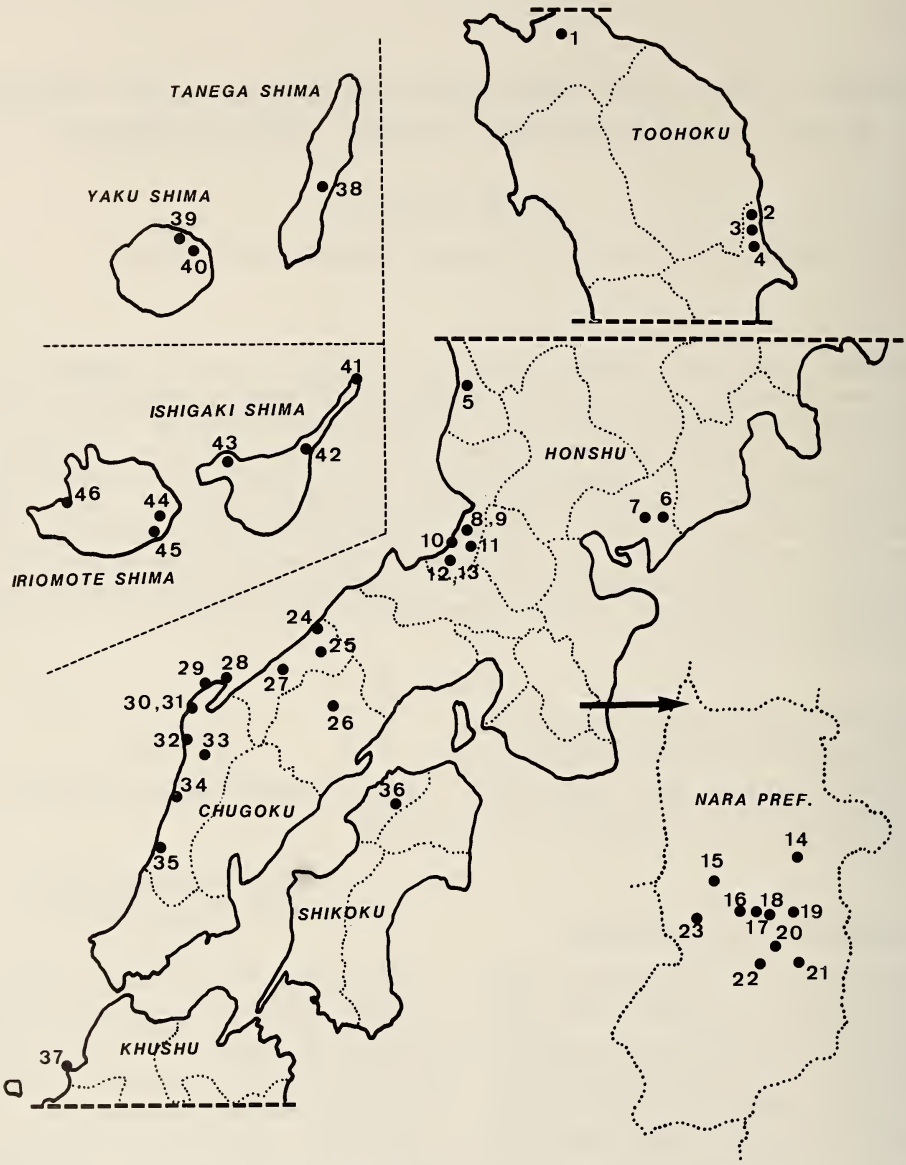

FIG. 1. Map showing the collection sites of bats. For locality numbers, see Table 1.

to middle of proglottid margins. Testes three in number, ovoid, 0.207–0.235 by 0.235–0.304, arranged in a transverse row or in form of triangle, one poral and two aporal. Cirrus sac pyriform, 0.373–0.415 by 0.070–0.111, extending anterolaterally behind osmoregulatory canals. Internal seminal vesicle, 0.194–0.277 by 0.055–0.083, enlarging to fill proximal portion of cirrus sac. External seminal vesicle oval, 0.277–0.290 by 0.138–0.166. Vagina posterior to cirrus sac and external seminal vesicle. Seminal receptacle dorsal to ovary, measuring 0.415 by 0.138. Ovary bilobed, 0.553–0.692 wide, situated in anterior field of proglottid. Vitelline gland compact, 0.069 by 0.138, situated in posterior field of proglottid near midline in space between first and second testes. Gravid proglottides unknown.

Type host: *Myotis macrodactylus*.

Site of infection: Small intestine.

Type locality and date: Nakatane-chô (Tane-

TABLE 1. Localities and dates of collections of bats and their cestode parasites, January-December 1983

Host species Cave and locality	Date of collection	Number of bats examined	infected	%	Cestode species
Hipposideridae					
(1) *Hipposideros turpis*					
43)* Daiichi-tabagabaru Ishigaki-shi, Okinawa Pref.	Jan. 22	5	0	0	
44) Ôtomi-dô Taketomi-chô, Okinawa Pref.	Jan. 24	6	0	0	
Rhinolophidae					
(2) *Rhinolophus cornutus cornutus*					
3) Kamaiwa-ana Kesennuma- shi, Miyagi Pref.	May 5	10	4	40	*Vampirolepis isensis*
4) Tatsu-ana Kesennuma-shi, Miyagi Pref.	May 5	20	0	0	
5) Mase-dô Komatsu-shi, Ishikawa Pref.	Dec. 4	7	0	0	
10) Shiraishi-dô Obama-shi, Fukui Pref.	Nov. 19	8	2	25	*V. isensis*
12) Abandoned mine, No. 1 Tanashô-chô, Fukui Pref.	Nov. 19	5	1	20	*V. isensis*
13) Abandoned mine, No. 2	Nov. 19	1	0	0	
14) Mio abandoned mine Higashiyoshino-mura, Nara Pref.	Sep. 9	5	1	20	*V. isensis*
19) Suishô-no-kutsu Kawakami-mura, Nara Pref.	Jan. 14	1	0	0	
21) Akakura abandoned mine Kamikitayama-mura, Nara Pref.	Apr. 5	11	0	0	
	Apr. 29	8	0	0	
	May 22	10	0	0	
	Sep. 14	4	0	0	
	Nov. 16	9	0	0	
	Dec. 4	7	0	0	
23) Kawamata abandoned mine Nishiyoshino-mura, Nara Pref.	Nov. 8	2	1	50	*V. isensis*
24) Ryujin-dô Iwami-chô, Tottori Pref.	Nov. 5	2	0	0	
26) Kôjirô-no-ana Katsuyama-chô, Okayama Pref.	July 28	3	1	33	*V. isensis*
32) Sea eroded cave Taki-chô, Shimane Pref.	Aug. 30	6	0	0	
34) Hiradokogawa abandoned mine Kawahira-chô, Shimane Pref.	Mar. 39	10	0	0	
35) Underground raceway Masuda-shi, Shimane Pref.	Mar. 28	10	2	20	*V. isensis*
(3) *Rhinolophus imaizumii*					
41) Hirano-dô Ishigaki-shi, Okinawa Pref.	Jan. 23	18	1	5	*V. iriomotensis*

TABLE 1. (Continued)

	Host species Cave and locality	Date of collection	Number of bats			Cestode species
			examined	infected	%	
42)	Inoda-iza Ishigaki-shi, Okinawa Pref.	Jan. 22	1	0	0	
45)	Ôtomi-daini-dô Taketomi-chô, Okinawa Pref.	Jan. 24	14	1	7	*V. isensis*
46)	Disused air raid shelter Taketomi-chô, Okinawa Pref.	Jan. 26	16	2	13	*V. isensis*
				1	6	*V. iriomotensis*
(4)	*Rhinolophus ferrumequinum nippon*					
2)	Bakuchi-ana Kesennuma-shi, Miyagi Pref.	May 5	5	5	100	*Hymenolepis rashomonensis*
5)	Mase-dô	Dec. 4	2	1	50	*H. rashomonensis*
6)	Dônomoto-dô Tôei-chô, Aichi Pref.	May 29	3	2	67	*H. rashomonensis*
7)	Jigoku-ana Shidara-chô, Aichi Pref.	May 29	1	1	100	*H. rashomonensis*
8)	Disused air raid shelter, No. 1 Obama-shi, Fukui Pref.	Nov. 19	2	2	100	*H. rashomonensis*
9)	Disused air raid shelter, No. 2	Nov. 19	2	0	0	
10)	Shiraishi-dô	Nov. 19	5	4	80	*H. rashomonensis*
13)	Abandoned mine, No. 2	Nov. 19	1	1	100	*H. rashomonensis*
15)	Kôyô abandoned mine Nishiyoshino-mura, Nara Pref.	May 21	2	1	50	*H. rashomonensis*
16)	Shinsen-dô Tenkawa-mura, Nara Pref.	Dec. 14	2	2	100	*H. rashomonensis*
17)	Kômori-no-kutsu Tenkawa-mura, Nara Pref.	Dec. 14	1	0	0	
18)	Tôrô-no-kutsu Tenkawa-mura, Nara Pref.	Dec. 14	2	0	0	
20)	Musô-dô Kamikitayama-mura, Nara Pref.	Jan. 16	2	0	0	
21)	Akakura abandoned mine	Apr. 29	1	1	100	*H. rashomonensis*
23)	Kawamata abandoned mine	Nov. 8	1	1	100	*H. rashomonensis*
24)	Ryujin-dô	Nov. 5	2	1	50	*H. rashomonensis*
25)	Itadani gongen-dô Fukue-mura, Tottori Pref.	Nov. 5	2	1	50	*H. rashomonensis*
26)	Kôjiro-no-ana	July 28	5	2	67	*H. rashomonensis*
27)	Sanmyôji old mound Sanmyôji-chô, Tottori Pref.	Nov. 6	1	0	0	
28)	Oo-ana Shimane-chô, Shimane Pref.	July 27	7	3	43	*H. rashomonensis*
30)	Inome-ana Inome-chô, Shimane Pref.	Mar. 29	2	2	100	*H. rashomonensis*
31)	Sea eroded cave Inome-chô, Shimane Pref.	Mar. 29	4	4	100	*H. rashomonensis*
32)	Sea eroded cave	Aug. 30	2	2	100	*H. rashomonensis*
33)	Mikomori-ana Nima-chô, Shimane Pref.	Mar. 29	2	2	100	*H. rashomonensis*

TABLE 1. (Continued)

Host species Cave and locality	Date of collection	Number of bats			Cestode species
		examined	infected	%	
35) Underground raceway	Mar. 28	1	0	0	
39) Disused tunnel Kamiyaku-chô, Kagoshima Pref.	Aug. 29	2	1	50	*H. nishidai*
40) Abandoned charcoal kiln Yaku-chô, Kagoshima Pref.	Aug. 29	2	2	100	*H. nishidai*
Vespertilionidae					
(5) *Miniopterus schreibersii fuliginosus*					
11) Water tunnel Kaminaka-chô, Fukui Pref.	Nov. 20	5	2	40	*H. rashomonensis*
29) Komori-ana Shimane-chô, Shimane Pref.	July 27	10	1	10	*V. hidaensis*
34) Hiradokogawa abandoned mine	Mar. 29	7	0	0	
(6) *Miniopterus schreibersii blepotis*					
45) Ôtomi-daini-dô	Jan. 24	12	3	25	*V. hidaensis*
(7) *Myotis macrodactylus*					
11) Water tunnel	Nov. 20	5	1	20	*V. wakasensis* sp. n.
19) Suishô-no-kutsu	Feb. 2	1	0	0	
21) Akakura abandoned mine	Nov. 16	1	0	0	
28) Oo-ana	July 27	2	0	0	
35) Underground raceway	Mar. 28	5	0	0	
36) Underground raceway Kotonami-chô, Kagawa Pref.	Aug. 25	5	0	0	
38) Tunnel Nakatane-chô, Kagoshima Pref.	Aug. 27	17	1	9	*V. tanegashimensis* sp. n.
			1	9	*V.* sp.
(8) *Plecotus auritus sacrimontis*					
15) Kôyô abandoned mine	May 21	1	0	0	
16) Shinsen-dô	Dec. 14	1	0	0	
19) Suishô-no-kutsu	Jan. 14	1	0	0	
21) Akakura abandoned mine	Apr. 29	1	0	0	
	Nov. 16	2	0	0	
22) Kôse abandoned mine Tenkawa-mura, Nara Pref.	Aug. 4	2	0	0	
(9) *Vespertilio namiyei*					
37) Sea eroded cave Ôtsukue-island, Fukuoka Pref.	Aug. 7	19	1	5	*unidentified* (larva)
(10) *Vespertilio orientalis*					
1) Temmadate shrine Temmabayashi-mura, Aomori Pref.	Aug. 21	5	5	100	*V. multihamata*

* Serial No. of localities shown in Fig. 1.

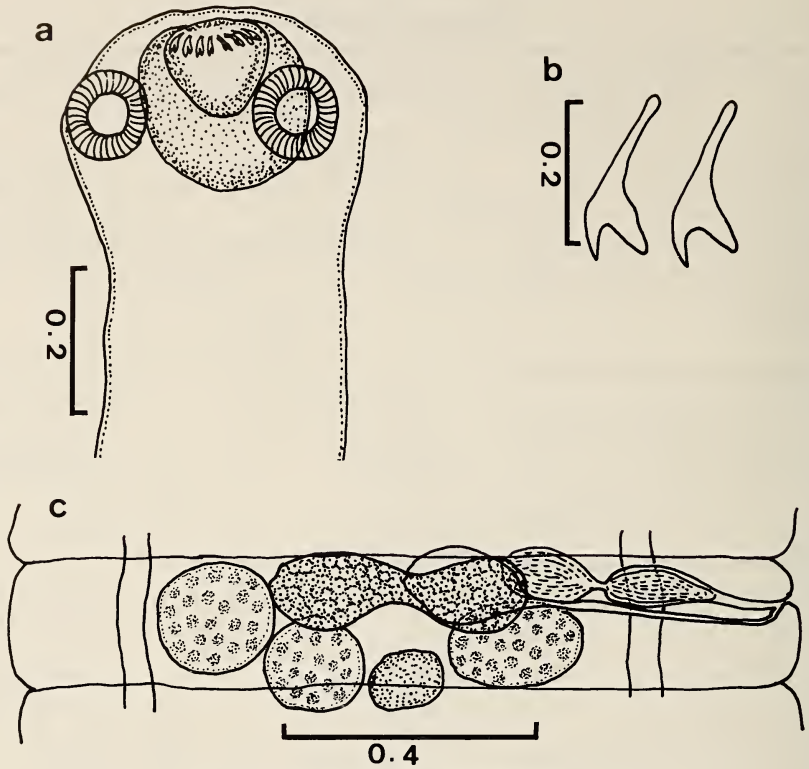

Fig. 2. *Vampirolepis tanegashimensis* sp. n.
a: Scolex. b: Rostellar hooks. c: Mature proglottid. Scales in mm.

gashima), Kagoshima Prefecture; August 27, 1983.

Type specimens: Holotype NUE Lab. Coll. No. 8301; paratype NUE Lab. Coll. No. 8302.

Remarks: The present new species most closely resembles *V. multihamata* Sawada, 1967 [1] from the Oriental frosted bat *Vespertilio orientalis* in the number and the length of rostellar hooks. However, it differs from *V. multihamata* in that the strobila is longer (42–46 vs. 20–25); the scolex is larger (0.277 by 0.457 vs. 0.105–0.119 by 0.246–0.280); the neck is slender (2.5 vs. absent); and the testes are larger (0.207–0.235 by 0.235–0.305 vs. 0.046–0.049 by 0.077). This is the first cestode to be reported from *M. macrodactylus* in Japan [2–5].

Vampirolepis wakasensis sp. n.
(Fig. 3)

Five bats, *Myotis macrodactylus*, were collected in a disused water tunnel at Kaminaka-chô, Fukui Prefecture, on November 20, 1983. One of them was found to be infected with two gravid specimens of this cestode.

Description: Medium-sized hymenolepidid; mature strobila 91–96 in length and 1.6–1.8 in maximum width. Strobila margins slightly serrate. All proglottides wider than long. Scolex round when the rostellum is invaginated, 0.280–0.315 by 0.385–0.399, not sharply demarcated from neck. Rostellum 0.105–0.112 by 0.133–0.140, armed with a crown of 42 Y-shaped hooks, each measuring 0.035 in length. Hook handle long; guard bluntly round at its end, shorter than blade. Suckers discoidal, unarmed 0.112–0.126 in diameter. Neck region behind scolex 1.5–1.8 long by 0.36–0.41 wide.

Genital pores unilateral, located a little anterior to middle of proglottid. Testes three in number, spherical, 0.112–0.133 by 0.119–0.140, situated in posterior field of proglottid, arranged in a transverse row or in triangular position, one poral and two aporal. Cirrus sac pyriform, 0.147–0.189

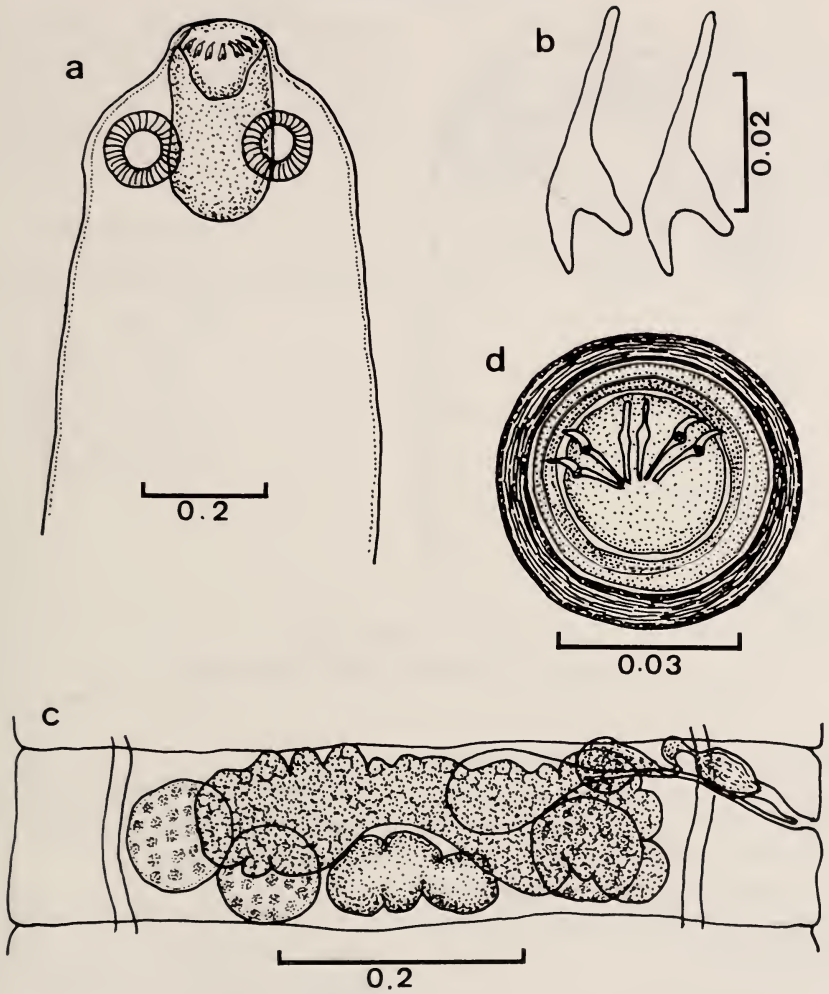

FIG. 3. *Vampirolepis wakasensis* sp. n.
a: Scolex. b: Rostellar hooks. c: Mature proglottid. d: Egg. Scales in mm.

long and 0.042 wide, occupied by internal seminal vesicle measuring 0.070–0.084 by 0.034–0.040. Duct from external seminal vesicle to cirrus sac forming a loop. External seminal vesicle, ellipsoidal, 0.105–0.140 by 0.049–0.056. Ovary transversely elongated and digitate in mature proglottid, 0.490–0.518 wide. Vitelline gland distinctly trilobated, 0.196–0.224 by 0.084–0.105, situated near midline in space between first and second testes in posterior field of proglottid. Vagina opening in genital atrium, extending to median field, posterior to cirrus sac. Seminal receptacle 0.154–0.180 by 0.084–0.098, situated anterior to poral testis. Uterus arising directly from ovarian lobes as a lobe sac, gradually enlarging, filling all available space in proglottid. Numerous eggs present in uterus, spherical or oval, 0.053–0.056 in diameter, surrounded by four envelopes, outermost chorion thick, with smooth surface. Onchosphere spherical, 0.032 in diameter; embryonic hooks 0.014 long.

Type host: *Myotis macrodactylus*.

Site of infection: Small intestine.

Type locality and date: Kaminaka-chô, Fukui Prefecture; November 20, 1983.

Type specimens: Holotype NUE Lab. Coll. No. 8303, paratype NUE Lab. Coll. No. 8304.

Remarks: The present species most closely

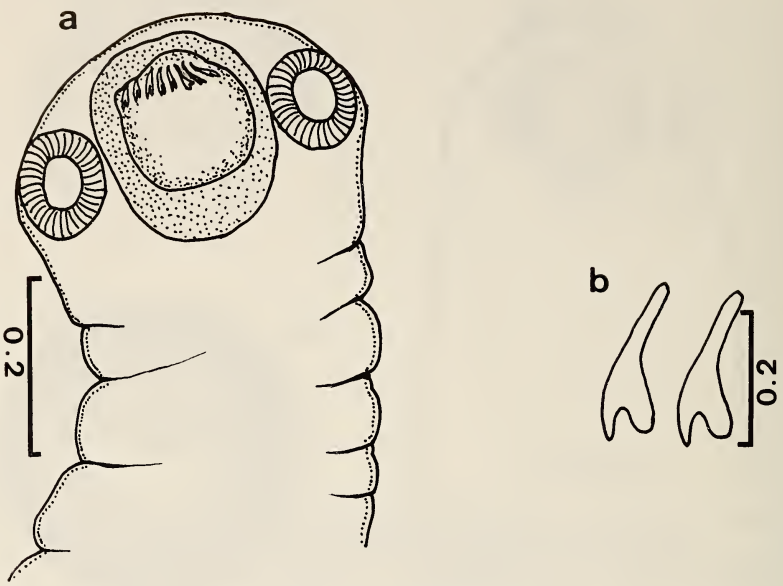

FIG. 4. *Vampirolepis* sp.
a: Scolex. b: Rostellar hooks. Scales in mm.

resembles the foregoing *Vampirolepis tanegashimensis* sp. n., but differs from it in that the rostellar hooks are longer (0.035 vs. 0.032) and more in number (42 vs. 40), and in the morphological features of the ovary (transversely elongated form vs. bilobed form) and the vitelline gland (trilobated form vs. compact form).

Vampirolepis sp.
(Fig. 4)

On August 27, 1983, 17 specimens of *M. macrodactylus* were collected in a disused tunnel at Nakatane-chô (Tanegashima), Kagoshima Prefecture. One of them harbored a larval cestode belonging to the genus *Vampirolepis*. Total length 4.2 and width 0.5. Scolex 0.280 long and 0.350 wide. Unarmed suckers round, 0.133–0.147 in diameter. Rostellum 0.147 by 0.161, armed with a single row of 38 hooks measuring 0.032; retractable elongated rostellar sac measuring 0.273 by 0.252. Neck absent.

Vampirolepis hidaensis Sawada, 1967

Host: *Miniopterus schreibersii fuliginosus*. For localities, see Table 1 and Figure 1.

Vampirolepis iriomotensis Sawada, 1982

Host: *Rhinolophus imaizumii*. For localities, see Table 1 and Figure 1.

Vampirolepis isensis Sawada, 1966

Host: *Rhinolophus cornutus cornutus, R. ferrumequinum nippon, R. imaizumii*. For localities, see Table 1 and Figure 1.

Hymenolepis Weinland, 1958
Hymenolepis rashomonensis Sawada, 1972

Host: *Rhinolophus ferrumequinum nippon*. For localities, see Table 1 and Figure 1.

Hymenolepis nishidai Sawada, 1982

Host: *Rhinolophus ferrumequinum nippon*. For localities, see Table 1 and Figure 1.

ACKNOWLEDGMENTS

This work was supported by a Grant-in-Aid for Scientific Research from the Ministry of Education, Science and Culture, Japan. I am deeply indebted to Mr. Masashi Harada, Laboratory of Experimental Animals, Osaka City University Medical School, for

his generous cooperation. I am also much indebted to Messrs. Junji Oohata, Yoshinori Shirotani, Terumasa Yamamoto, Tadato Kiyosue, Tsuneo Tamaki, Shizuya Honma, Tetsuya Sano, Hirozuki Furihata, Hidekazu Kawashima, Junichi Inoue and Yûzô Iguchi for collecting bats in caves and abandoned mines.

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